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Buell et al.

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[54] **WASHER FOR ESTABLISHING ELECTRICAL CONTINUITY BETWEEN CONDUCTIVE COMPONENTS HAVING NON-CONDUCTIVE COATINGS**

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[73] Assignee: **Federal-Hoffman, Inc.**, Anoka, Minn.

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Related U.S. Application Data

[63] Continuation of Ser. No. 164,194, Dec. 8, 1993, abandoned.

[51] **Int. Cl.**[6] **H01R 11/12**

[52] **U.S. Cl.** **439/433**; 439/426; 439/434; 439/883

[58] **Field of Search** 439/387, 426, 439/433, 434, 883, 864, 533, 160, 161, 162, 163, 164, 165

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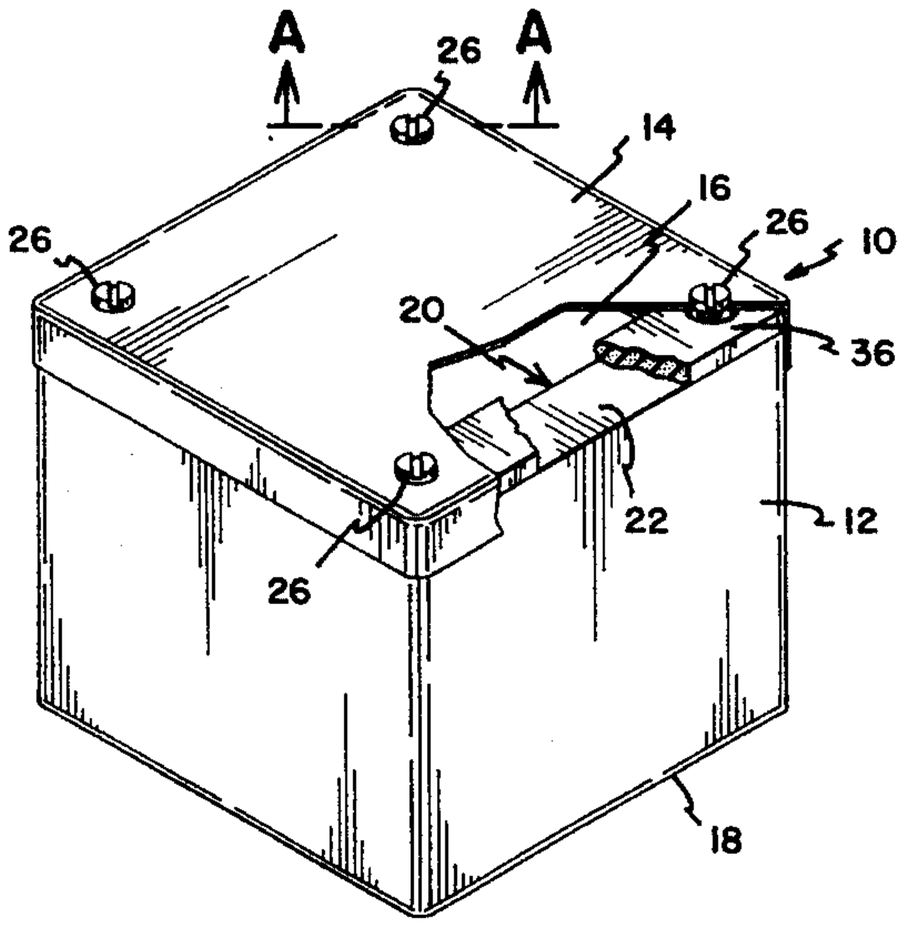
[57] **ABSTRACT**

The invention comprises a washer for establishing electrical continuity between two conductive members each having a non-conductive coating and which are secured together by threaded fasteners such as screws. The washer has projections that pierce the non-conductive coatings of the two conductive components as the threaded fasteners are tightened thereby establishing electrical continuity through the washer.

1 Claim, 3 Drawing Sheets



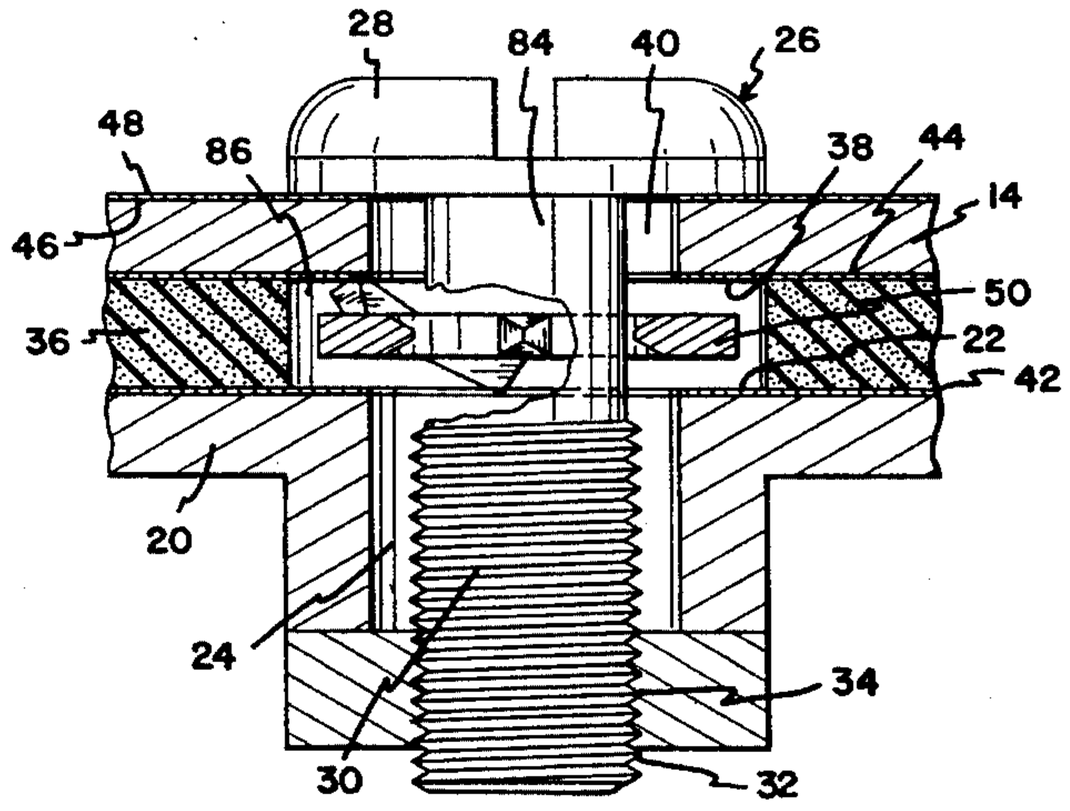
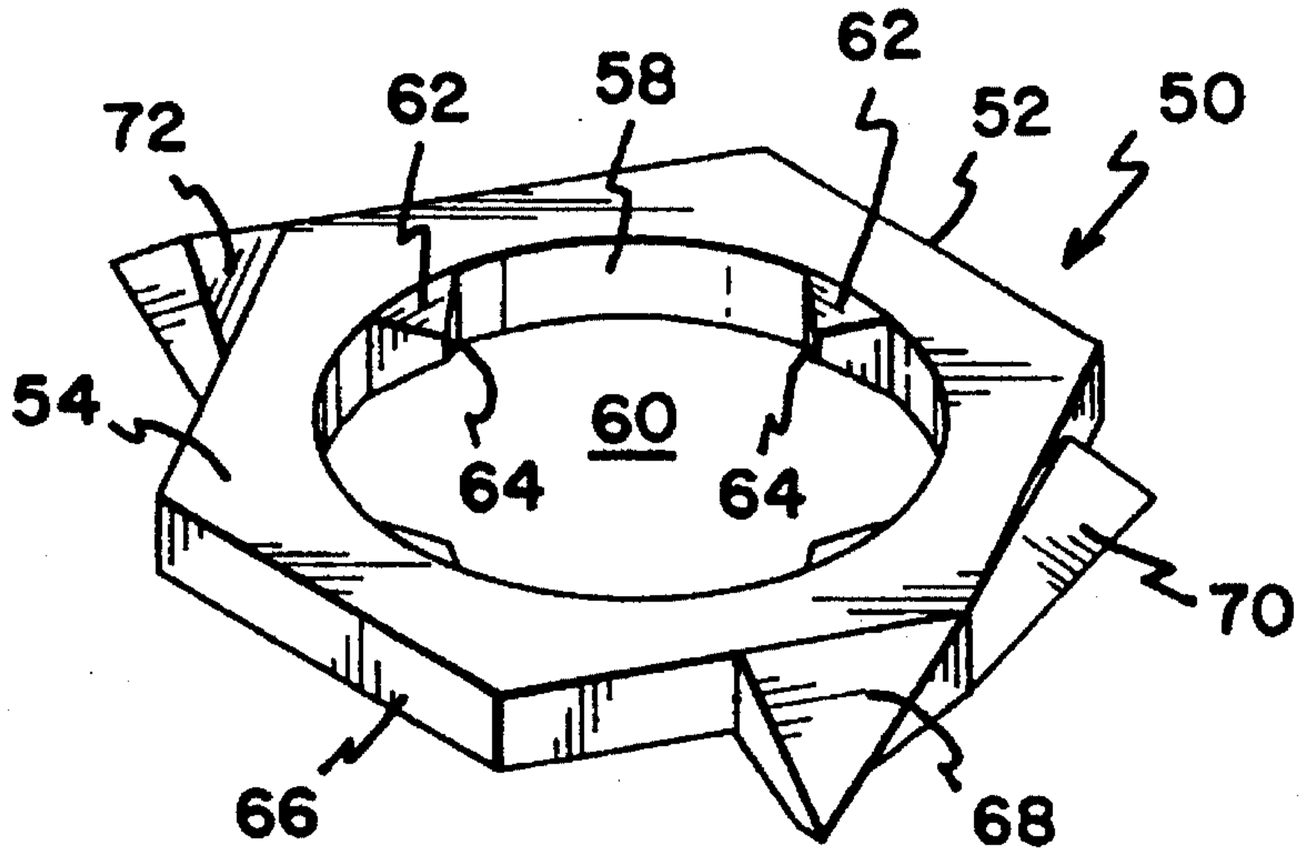


FIG. 2


72
62
58
62
52
50
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60
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70
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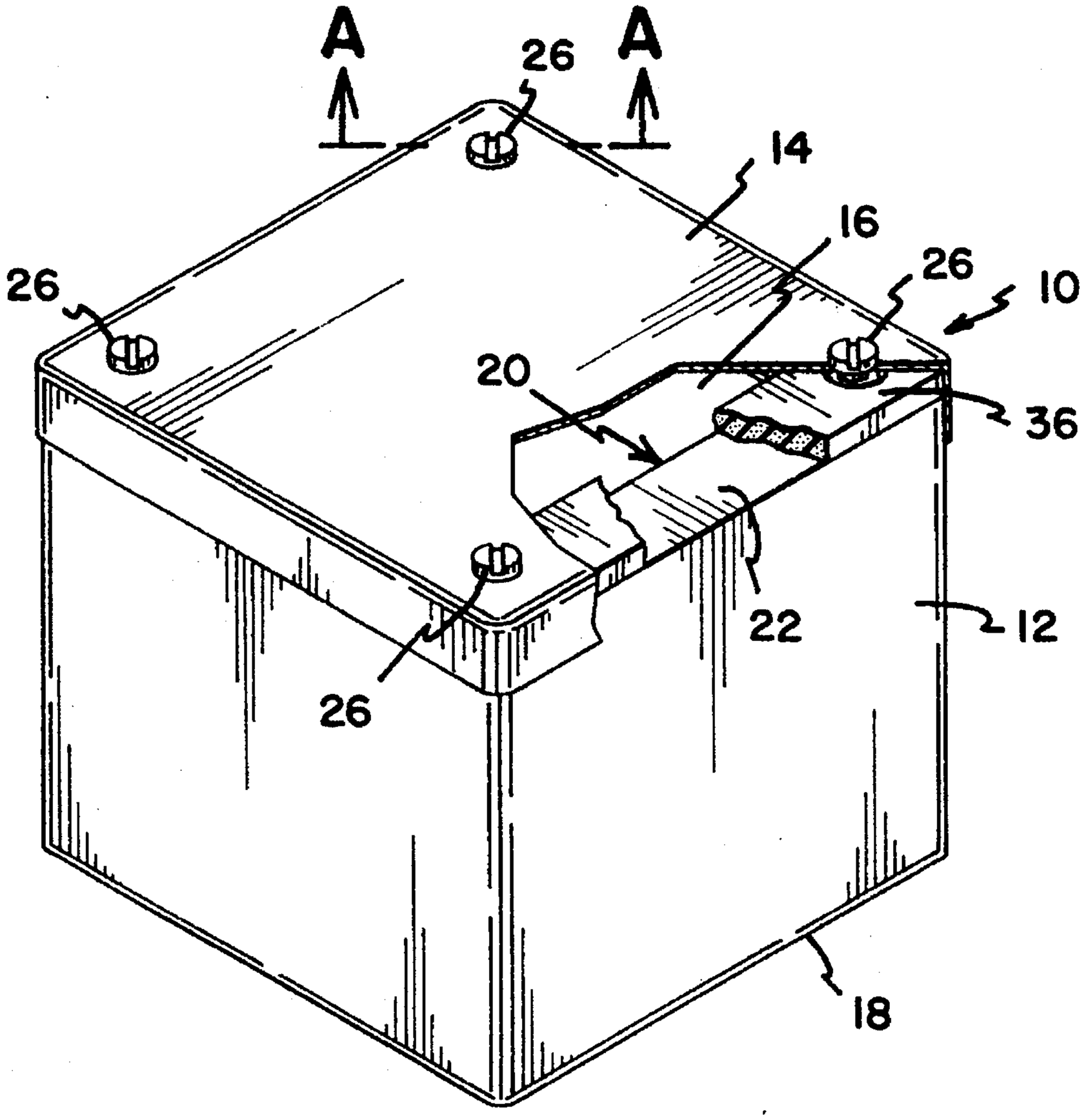
FIG. 1


A
A
26
14
16
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10
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20
36
22
12
26
18

FIG. 3

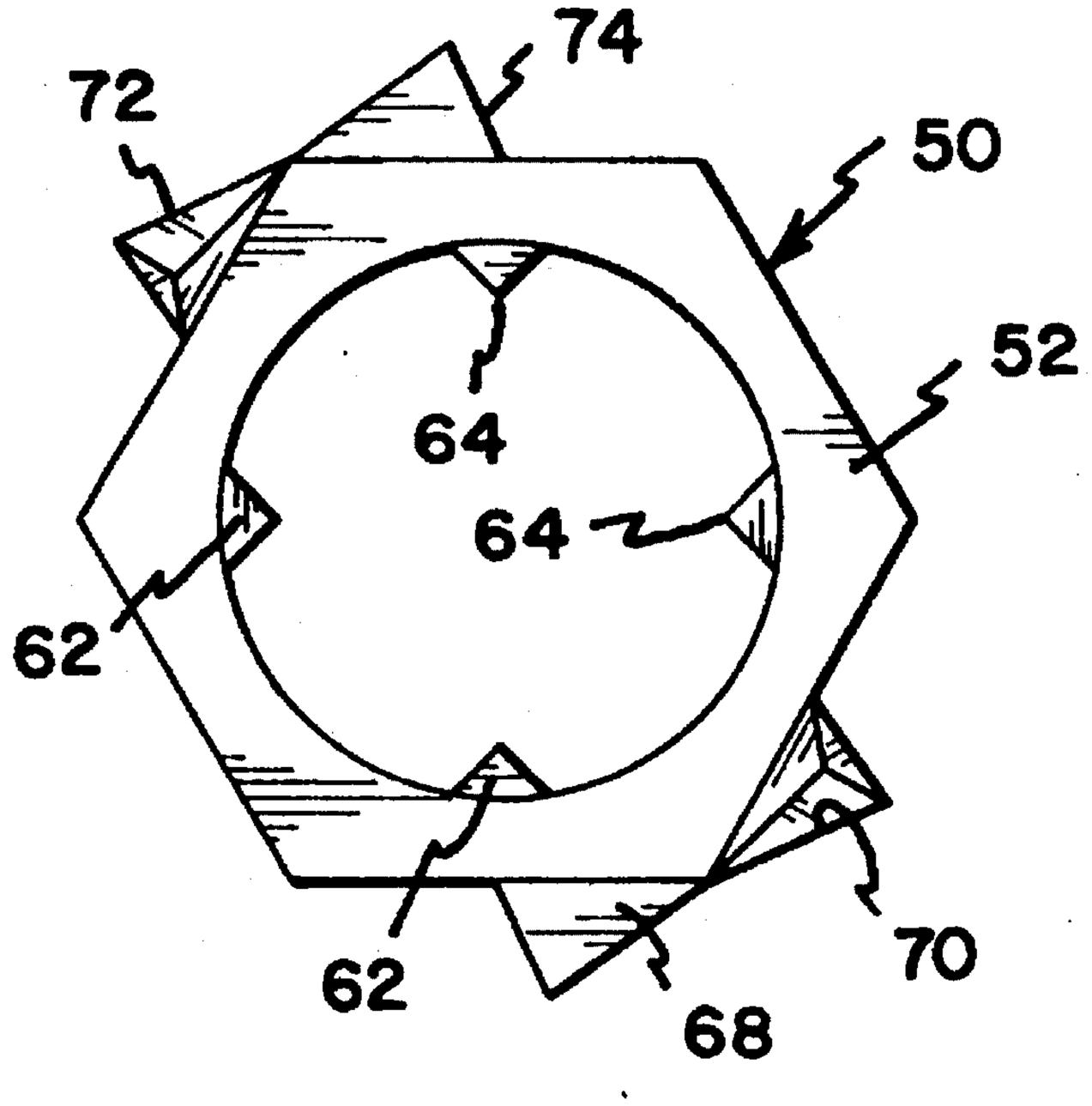


FIG. 4

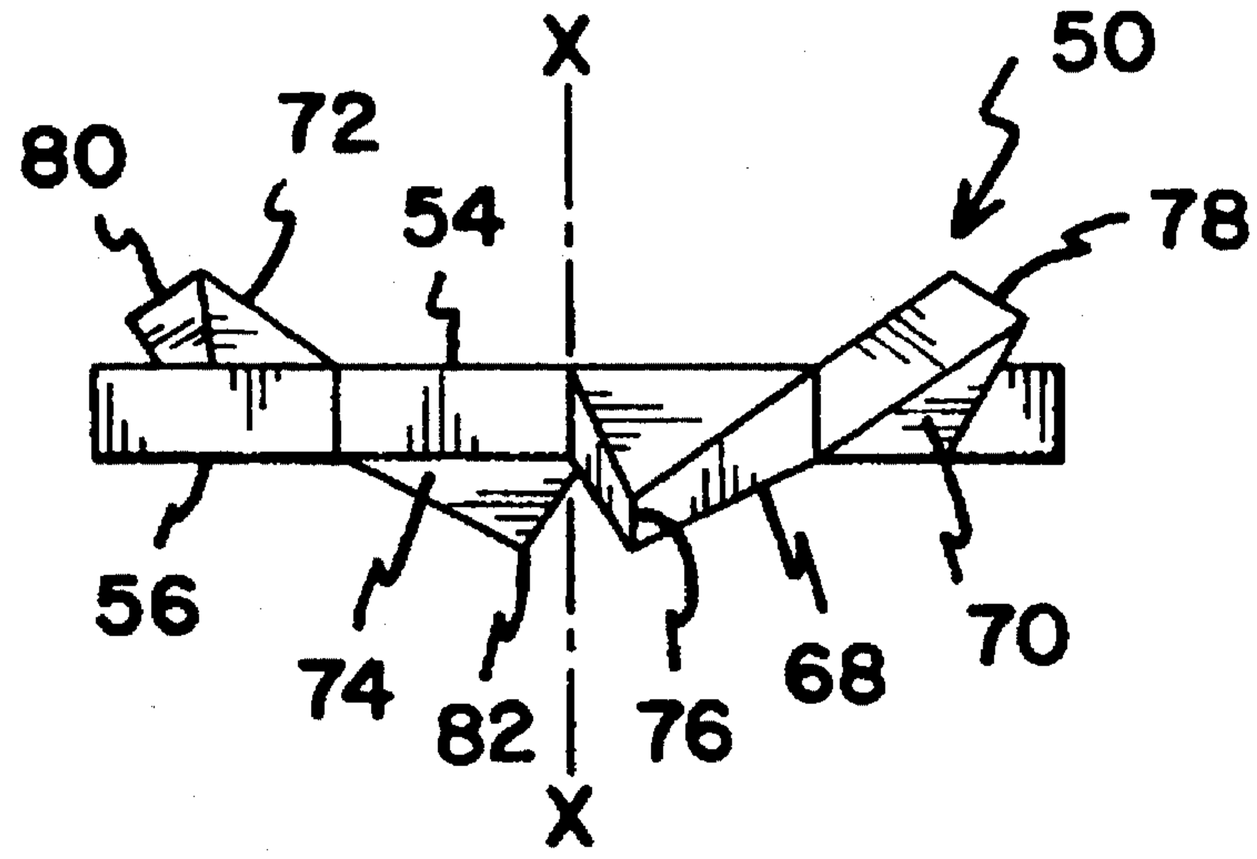
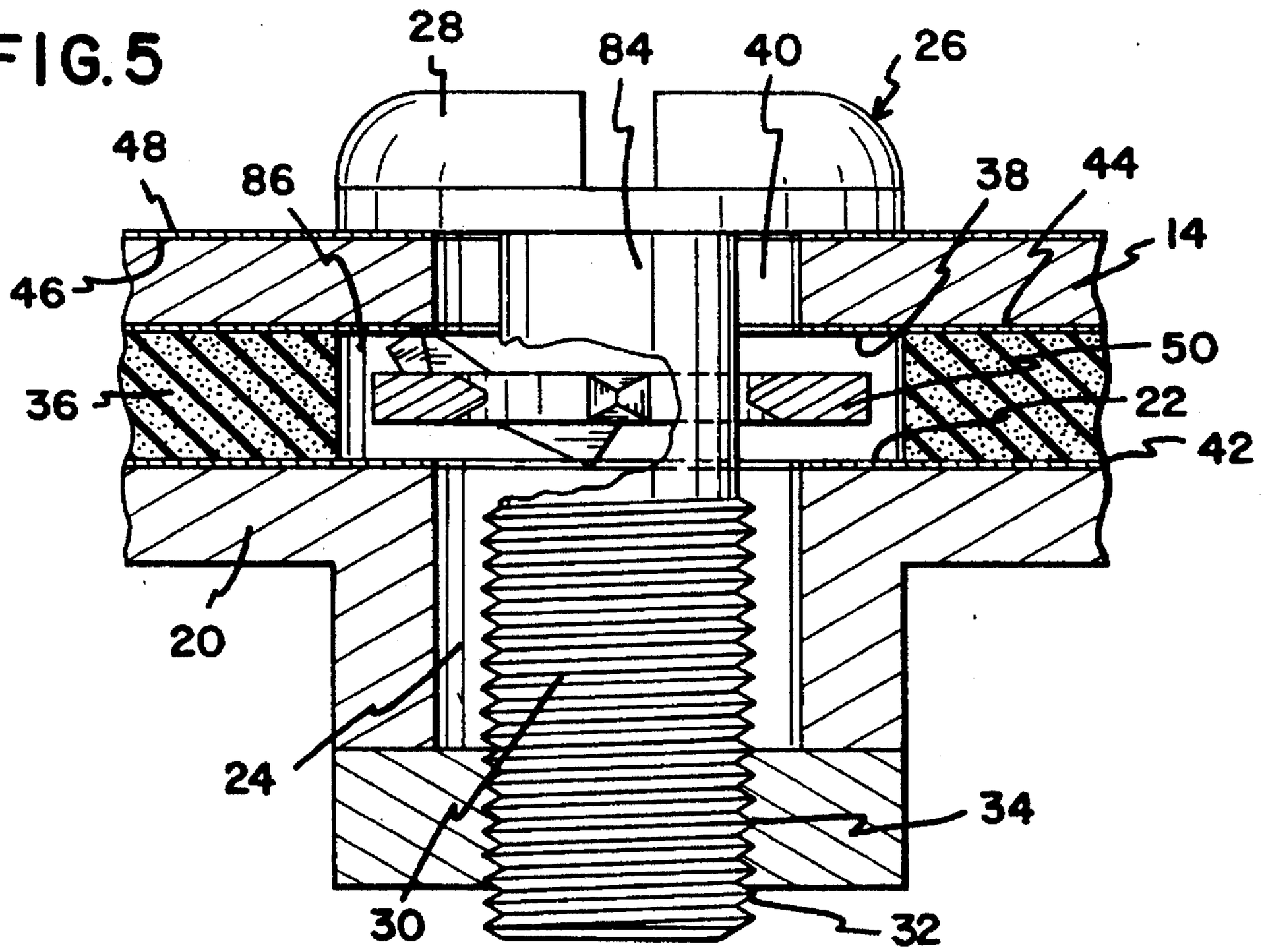


FIG. 5



WASHER FOR ESTABLISHING ELECTRICAL CONTINUITY BETWEEN CONDUCTIVE COMPONENTS HAVING NON-CONDUCTIVE COATINGS

This is a CONTINUATION of application Ser. No. 08/164,194, filed Dec. 8, 1993, now abandoned.

BACKGROUND OF THE INVENTION

The present invention relates broadly to a washer adapted to establish electrical continuity between conductive components fastened together each of which has a non-conductive coating. The present invention has particular applicability to the field of electrical housings or enclosures. Typically such enclosures are metal boxes in which electrical components and/or electrical wiring is enclosed. The enclosure has a removable access cover. While both the enclosure housing and access cover are conductive metal the surfaces of each are covered with a protective non-conductive coating such as paint. Frequently it is desirable to electrically ground the enclosure including the access cover. To establish electrical continuity between the enclosure housing and the access cover in the prior art the non-conductive coating would be removed from the surfaces of the housing and access cover around cooperating bore holes in the two components which received fasteners such as screws for securing the components together. Another prior art method involved leaving the surfaces of the enclosure and access cover around the bore holes uncoated during the manufacturing process. Each of these prior art methods increased manufacturing and assembly costs.

The present invention provides a means to establish electrical continuity between the two coated components without the need for these additional manufacturing and assembly steps.

SUMMARY OF THE INVENTION

The present invention is a washer having a generally planar ring member with an opening in which is received a threaded fastener such as a screw which secures two conductive components to each other. The washer has a plurality of projecting members disposed about the periphery of the ring member. The ring member has first and second planar surfaces lying in parallel planes generally perpendicular to the central axis of the washer. At least one of the projecting members extends above the first planar surface of the ring member and at least one projecting member extends above the second planar surface of the ring member. The projecting members are adapted to penetrate or pierce non-conductive coatings on the mating conductive components to establish electrical continuity therebetween. As the threaded fasteners are tightened the projecting members pierce the coated surfaces of the components being secured together.

In the preferred embodiment of the present invention the ring member of the washer has a plurality of teeth disposed about its inner surface to engage the threads of the fastener. This serves to capture the washer on the fastener. The threaded fastener will then remain captured in the bore hole of the component receiving the fastener. The two components can thus be separated without the fasteners becoming loose and possibly being misplaced or lost.

In many applications of the present invention a sealing gasket is provided at the mating surfaces of the two electrical components. The gasket is typically a compressible material such as rubber. The effectiveness of the seal can be compromised if the gasket is overcompressed when the fasteners are tightened to secure the two components together. A further advantage of the present invention is that the projecting members on the washer function as a compression stop. In other words the projecting members limit the extent to which the threaded fastener can be tightened leaving a predetermined minimum spacing for the sealing gasket. These and other advantages of the present invention will become apparent with reference to the accompanying drawings, detailed description of the preferred embodiment and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a view in perspective with a portion cut away illustrating the use of the present invention;

FIG. **2** is a view in perspective of the washer of the present invention;

FIG. **3** is a plan view of the washer of the present invention;

FIG. **4** is a view in elevation of the washer of the present invention;

FIG. **5** is a view in section taken along the line A—A of FIG. **1** with a portion cut away.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. **1** illustrates the use of the washer of the present invention in an enclosure **10**. Enclosure **10** is of the type used to house electrical components. Enclosure **10** includes a housing **12** and a cover **14**. Housing **12** has an open end at **16** and a closed end at **18**. Extending about open end **16** is a rim member **20** having a generally planar surface **22**. Rim member **20** is provided with a plurality of threaded bores, one of which is shown in FIG. **5** at **24**. The threaded bores **24** are adapted to receive a threaded fastener such as a screw **26**. As shown in more detail in FIG. **5** screw **26** has a head member **28** and a body **30** with external threads **32** adapted to mate with threads **34** of bore **24**.

As shown in FIGS. **1** and **5** a gasket **36** is disposed between planar surface **22** of rim member **20** and an inner surface **38** of cover **14**. Gasket **36** is formed of a compressible material, such as rubber or foam, and provides a seal between housing **12** and cover **14**. Cover **14** is provided with a plurality of bore holes, one of which is illustrated at **40** in FIG. **5**. Bore holes **40** receive screw **26**.

Cover **14** and housing **12** are formed of an electrically conductive material, typically a metal. As shown in FIG. **5** planar surface **22** of rim member **20** has a non-conductive coating **42**. Cover **14** also has a non-conductive coating **44** on inner surface **38**. Cover **14** has an outer surface **46**. A non-conductive coating **48** is also provided on outer surface **46**.

In many applications electrical continuity must be established between cover **14** and housing **12**. When enclosure **10** contains electrical components, for example, housing **12** is typically grounded and therefore it is important to also ground cover **14**. The present invention includes a washer **50** which establishes the electrical continuity between one conductive component, housing **12** and the other conductive component, cover **14**. Washer **50** is formed of an electrically conductive material such as stainless steel and has a ring member **52** that is essentially hexagonal in shape. Ring member **52** has a first planar surface **54** and a second planar surface **56**. Surfaces **54** and **56** are disposed in parallel

planes essentially perpendicular to a central axis of ring member **52** indicated by the designation X—X. Ring member **52** has an inner surface **58** which defines an opening **60** for receiving screw **26**. Disposed about the circumference of inner surface **58** are a plurality of inwardly projecting teeth **62**. Each of teeth **62** has an inwardly projecting apex as shown at **64**.

Ring member **52** has an outer surface **66** which in the embodiment illustrated comprises six faces. Disposed about ring member **52** on outer surface **66** are a plurality of projecting members **68**, **70**, **72** and **74**. In the illustrated preferred embodiment a pair of projecting members **68** and **70** are diametrically positioned on ring member **52** with respect to a pair of projecting members **72** and **74**. Each of projecting members **68–74** are formed to have a sharpened edge as shown in FIG. **4** at **76**, **78**, **80** and **82**, respectively. Projecting members **70** and **72** extend above first planar surface **54**. Stated differently, projecting members **70** and **72** intersect the plane of first planar surface **54**. Projecting members **68** and **74** extend above second planar surface **56**. Also stated differently, projecting members **68** and **74** intersect the plane of second planar surface **56**.

As shown in FIG. **5** washer **50** is inserted over threaded body **30** of screw **26**. Body **30** has a smooth or non-threaded portion at **84**. While washer **50** will fit loosely about smooth portion **84**, teeth **62** frictionally engage the threads of body **30** thereby capturing washer **50** on screw **26**. Gasket **36** is provided with an opening **86** accommodating washer **50**. To secure cover **14** to housing **12** screw **26** with its captured washer **50** is inserted into threaded bore **24**. Bore hole **40**, bore **24** and washer **50** are sized so that when screw **26** is inserted in threaded bore **24** projecting members **68**, **70**, **72** and **74** engage planar surfaces **22** and **38**. In other words projecting members **68**, **70**, **72** and **74** must extend radially from central axis X—X beyond the circumference of bore hole **40** and threaded bore **24**. As screw **26** is tightened to secure cover **14** to housing **12**, sharpened edges **76** and **82** scrape coating **42** from surface **22** while sharpened edges **78** and **80** similarly scrape coating **44** from inner surface **38**. Washer **50** thus establishes electrical continuity between cover **14** and rim member **20** of housing **12**. Projecting members **68–74** also establish a spacing between cover **14** and rim member **20**. This limits the extent to which screw **26** may be tightened and thus the extent to which gasket **36** is compressed. Washer **50** thus in addition to establishing electrical continuity also serves as a compression stop to preserve the integrity of the seal provided by gasket **36**.

If it becomes necessary to remove cover **14** from housing **12** for maintenance or service of the electrical components within enclosure **10**, screws **26** are loosened and withdrawn from threaded bore **24**. Washer **50** remains captured between threads **32** on body **30** and inner surface **38** of cover **14**. This serves to capture screw **26** within bore hole **40**. Thus neither screw **26** or washer **50** can be lost when cover **14** is removed.

It can be seen that the present invention is a washer that quickly and easily establishes electrical continuity between two mating electrically conductive components having non-conductive coatings. The washer is also designed to capture the fastening means to one of the components to prevent loss of the fasteners. The washer is also designed to limit the compression of a sealing gasket provided between the two joined components.

What is claimed is:

1. In an electrical housing having first and second housing members secured together by threaded fasteners received within corresponding apertures in said housing members, said first and second housing members formed of electrically conductive material and having a non-conductive protective coating and a sealing gasket disposed between the first and second housing members, the improvement comprising:

a washer formed of conductive material and having a substantially planar ring member with an inner surface defining an opening adapted to receive a threaded fastener, a central axis, and first and second surfaces lying in parallel planes substantially perpendicular to said central axis, said ring member having a first projection extending from said ring member above said first surface to engage a coated surface of the first housing member and a second projection extending from said ring member above said second surface to engage a coated surface of the second housing member, said first and second projections adapted to penetrate the non-conductive coatings to establish electrical continuity between said first and second housing members upon tightening of the threaded fastener to secure the first and second housing members together and

whereby said first and second projections form a compression stop preventing over-tightening the threaded fastener; and

said ring member having a plurality of teeth projecting into said opening to engage the threaded fastener thereby retaining said washer on the fastener.

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